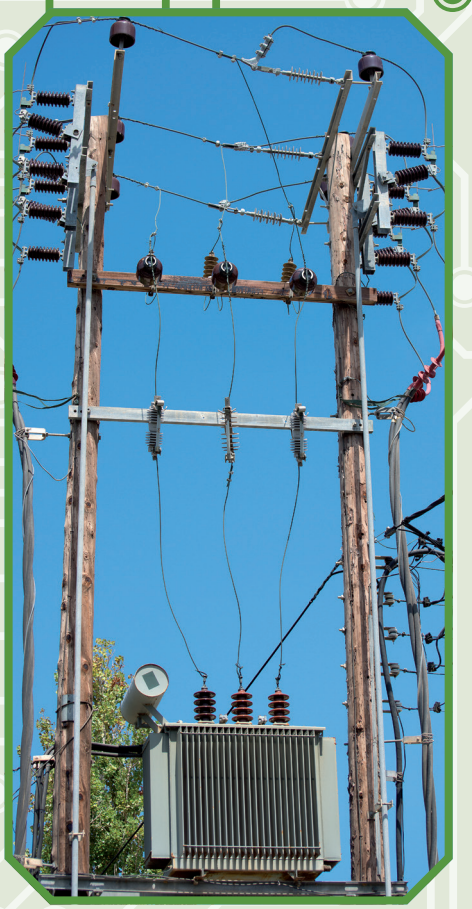

Smart infrastructure

If the EU is to reach its climate targets, it must adapt its infrastructure, says **Dirk Van Hertem**

Last year, EU heads of state agreed on new climate and energy targets to 2030, aiming to reduce greenhouse gas emissions and increasing energy efficiency. However, as KU Leuven assistant professor Dirk Van Hertem notes, this means setting up the right infrastructure. As it turns out, he tells this magazine, the way energy is transmitted is just as important as the way it is produced.

"Transmission infrastructure is going to be even more important when moving forward towards a near 100 per cent renewable energy supply", he explains. "First, renewable energy sources typically have a variable and uncertain character, which has a strong geographic correlation – both for sun and wind, their energy production in nearby locations is linked. Through transmission infrastructure, this effect is smoothened over longer areas, avoiding over-investment in renewable energy sources (RES). Local storage is a competing technology in this case."

"Second, there are many RES available away from the load centres and at the boundaries of our energy system. There are vast wind resources offshore, solar energy is available in southern Europe and northern Africa and hydro energy is available in Scandinavia and the Alps. Making use of these sources is expected to be much more energy, and cost, efficient. In order to make use of these remote sources, sufficient transmission capacity is needed to make this energy available to all users at the lowest cost."

"Third, the interconnected transmission network makes it possible to operate the power system in a reliable manner with a more stable and consistent cost of energy, which is especially important for the remaining industry in Europe", says Van Hertem.

In terms of the European transmission system, the researcher says, "there are a number of developments in progress. These focus on making better use of the available transmission capacity, by either adding controllability to the system or making its operations more flexible"

"Controllability can be added through better monitoring, for instance through the use of dynamic line rating, or through the use of wide area monitoring, and installing devices which provide enable system operators to manage the flow through their system in a dynamic manner. Devices such as high voltage direct current transmission and phase shifting transformers are causing a shift in how the system is used in normal operations and during alert or emergency events."

> *"If we consider the uncertain future of nuclear in Europe, and the recent abrupt changes in solar energy [...] as well as the price of fossil fuels [...] through the sudden appearance of shale gas, [...] it is extremely difficult to anticipate investments"*

"A smarter transmission system also means making optimal use of the capability of installed systems. Through better awareness of the actual operating points, system operators

will be able to optimally use the capacity of the installed transmission lines and to adapt according to the situation using corrective control actions."

However, Van Hertem says there are challenges ahead, and Europe will have to adapt its infrastructure in order to face these. He says, "in the short-term, changes need to be made to improve management of the system's reliability. Currently, systems are operated in a rather conservative manner, putting reliability at the forefront. Typically this is done using the N-1 approach, which states that the system cannot fail when any single element fails. While a reliable energy supply is clearly essential for the operation of modern society, this deterministic manner may not offer that reliability in the most cost effective way. The increased uncertainty in the power system caused by both RES integration and market developments is also driving towards risk-based management of reliability, something which is currently barely done, and in some cases not even allowed."

Additionally, Van Hertem tells the Parliament Magazine that there needs to be better coordination between system operators. Another challenge is being able to plan for smart transmission systems with enough foresight. "The future requirements depend largely on the available generation resources in the future, and their location, which is highly uncertain. If we consider the uncertain future of nuclear in Europe, and the recent abrupt changes in solar energy – through subsidies – as well as the price of fossil fuels – through shale gas – and the difference in offshore developments in Germany and the UK compared to the rest of Europe, it is extremely difficult to anticipate investments. The actual lead time for infrastructure investments does not help: 10 years to plan and approve a transmission investment is not a rarity."

> *"Transmission infrastructure is likely going to be even more important when moving forward towards a near 100 per cent renewable energy supply"*

"Overall", says Van Hertem, "the current regulatory framework is insufficient to make optimal use of available technologies. Stronger harmonisation and system wide regulation would force the system to be more efficient. An example here are the national generation capacity targets in an internal European energy market. These targets are counter-effective and market distorting. They have led to generation shortages in several countries, without current incentives to invest in generation. The current 'solution' of implementing different capacity remuneration schemes in each country avoids addressing the real problem. The approach is national while the problem is system-wide."

The European Commission could be instrumental here, by "pushing for more harmonised energy systems and pan-European collaboration. As the electrical power sector is very strong in Europe, with leading companies in technology development and in renewable energy, the Commission could play a role to gather the current dispersed knowledge and – limited – human resources available in Europe and collaborate more intensively, and this to remain leading at a global level in the long run. The commission might also encourage investments in a smarter infrastructure through the creation of elements which hedge the risks in new technologies to accommodate the risk averse power sector."

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